

# Autonomous On-Board Optical Navigation Beyond Earth Orbit

Completed Technology Project (2012 - 2013)



## Project Introduction

Investigate on-board optical navigation in three ways: 1) identify algorithms that can be used to analyze video information to determine location of celestial objects, 2) develop a test environment that simulates the visible mission environment, and 3) conduct tests of these algorithms on a flight-like computer, implemented in Core Flight Software (CFS). Task will make use of newly acquired capabilities within NASA/JSC laboratories, including a Star Field emulator connected directly to a mission simulation; flight-like avionics boards to perform required analysis.

To date, navigation solutions are created by ground systems teams and then uploaded to vehicles operating beyond Earth orbit. However with the improvement of space-based optical cameras and the increase in computer processing power, it is now possible to develop a technology for on-board navigation state determination. This capability would improve the safety of crew by ensuring valid knowledge of vehicle state between updates from the ground, to support nominal and abort operations. This proposal will investigate on-board optical navigation in three ways: 1) identify algorithms that can be used to analyze video information to determine location of celestial objects, 2) develop a test environment that simulates the visible mission environment, and 3) conduct tests of these algorithms on a flight-like computer, implemented in Core Flight Software (CFS).

## Anticipated Benefits

Outcomes: This project will develop an environment for current and future optical navigation analysis, and will produce algorithms and flight-like code to show the feasibility of on-board optical navigation. •



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

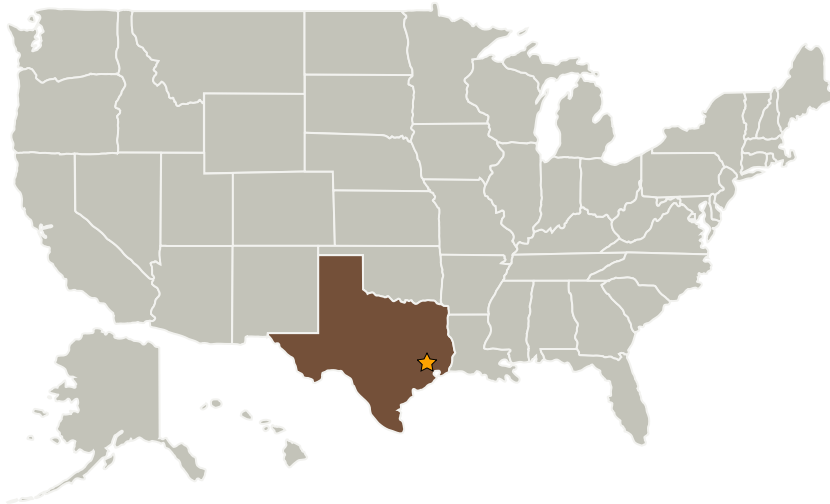
Center Innovation Fund: JSC CIF

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas

## Primary U.S. Work Locations

Texas

## Project Management

**Program Director:**

Michael R Lapointe

**Program Manager:**

Carlos H Westhelle

**Project Manager:**

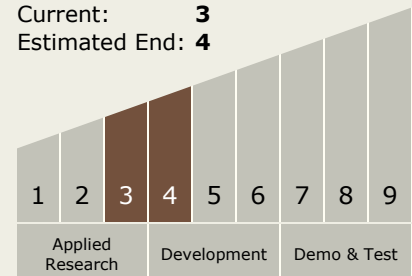
Scott P Cryan

**Principal Investigator:**

Scott P Cryan

## Technology Maturity (TRL)

Start: 3  
 Current: 3  
 Estimated End: 4



## Technology Areas

**Primary:**

- TX17 Guidance, Navigation, and Control (GN&C)
  - └ TX17.2 Navigation Technologies
    - └ TX17.2.1 Onboard Navigation Algorithms